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(54) **METHODS, APPARATUS, AND ARTICLES OF MANUFACTURE TO RANK WEB SITE INFLUENCE**

(71) Applicant: **BUZZMETRICS, LTD.**, Herzliya (IL)

(72) Inventors: **Yakir Krichman**, Givat Hen (IL);
Eliyahu Greitzer, Herzliya (IL)

(73) Assignee: **The Nielsen Company (US), LLC**, New York, NY (US)

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CPC **G06F 17/30864** (2013.01); **G06Q 30/02** (2013.01)

(58) **Field of Classification Search**
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USPC 707/608, 723, 790, 813, 821, 964
See application file for complete search history.

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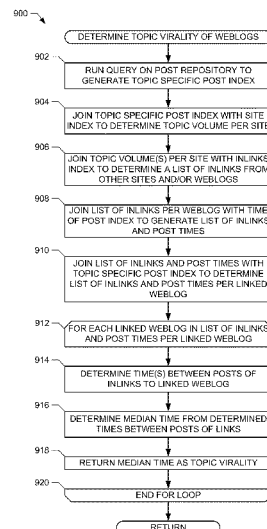
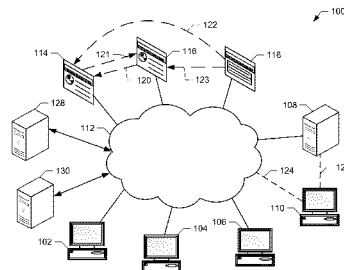
Primary Examiner — Sana Al Hashemi

(74) *Attorney, Agent, or Firm* — Hanley, Flight & Zimmerman, LLC

(57) **ABSTRACT**

Methods, apparatus, and articles of manufacture to rank a web site are disclosed herein. An example method to rank the influence of a web site includes accessing a query based on a topic term, determining topic specific posts by applying the query to a first plurality of posts to a web site, comparing the topic specific posts to a list of web sites to determine a topic volume per site, determining a plurality of inbound links to the first plurality of posts, determining a number of inbound links to the posts that are relevant to the topic term by comparing the topic volume per site and the inbound links, and generating a rank of the web site based on the number of inbound links to the posts that are relevant to the topic term and times between the inbound links.

22 Claims, 10 Drawing Sheets



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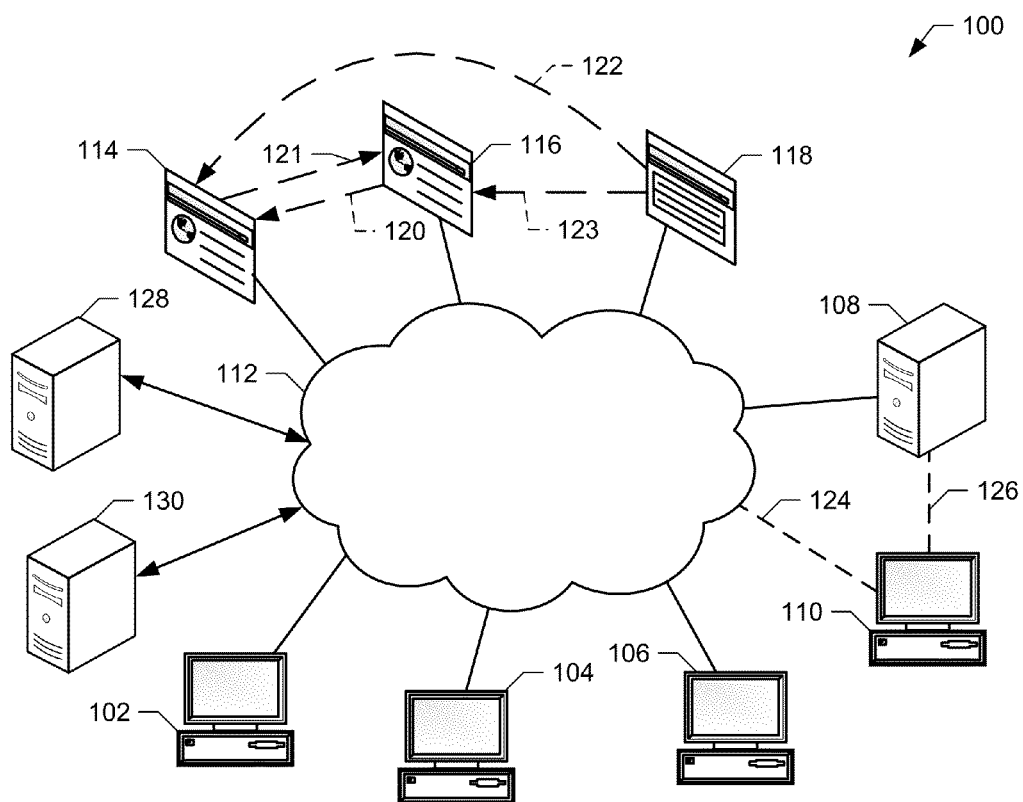


FIG. 1

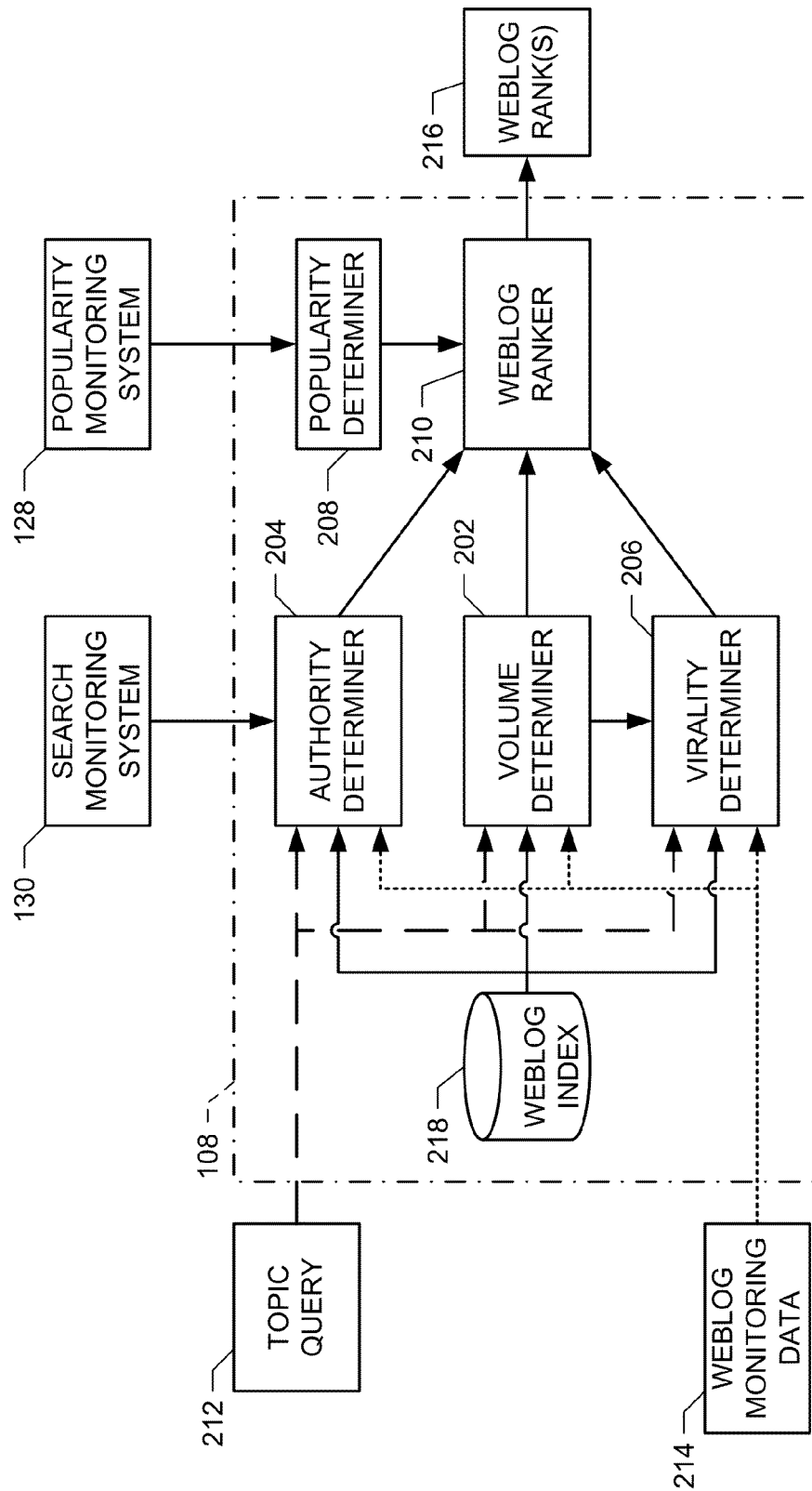


FIG. 2

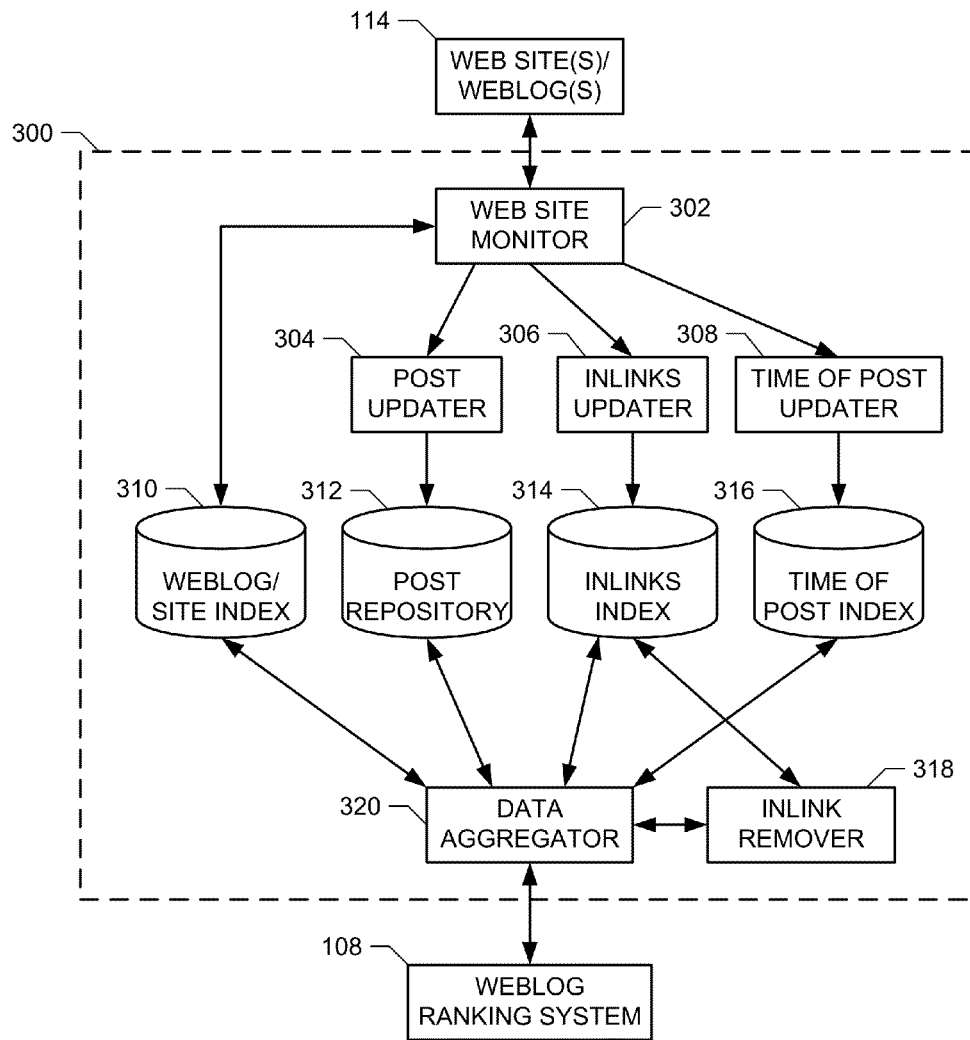


FIG. 3

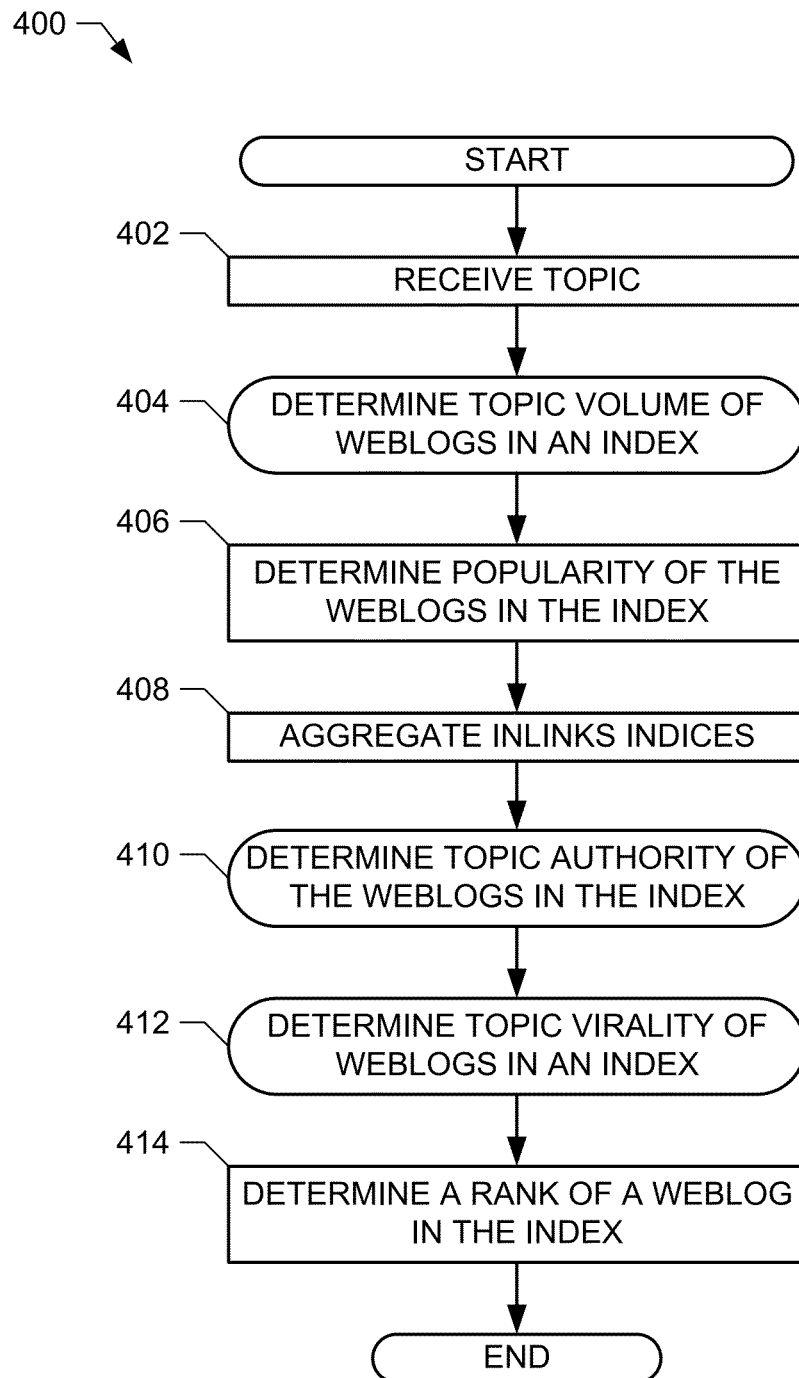


FIG. 4

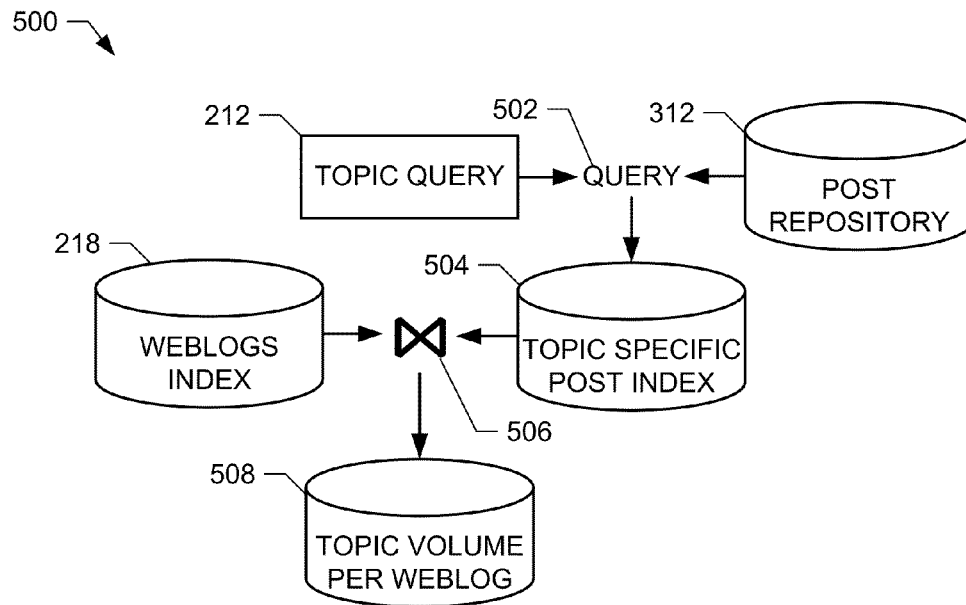


FIG. 5

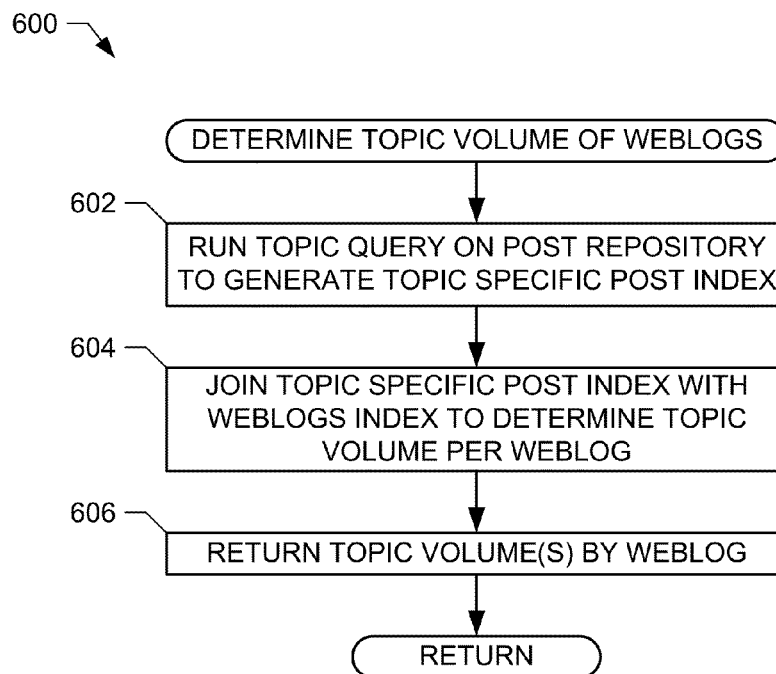


FIG. 6

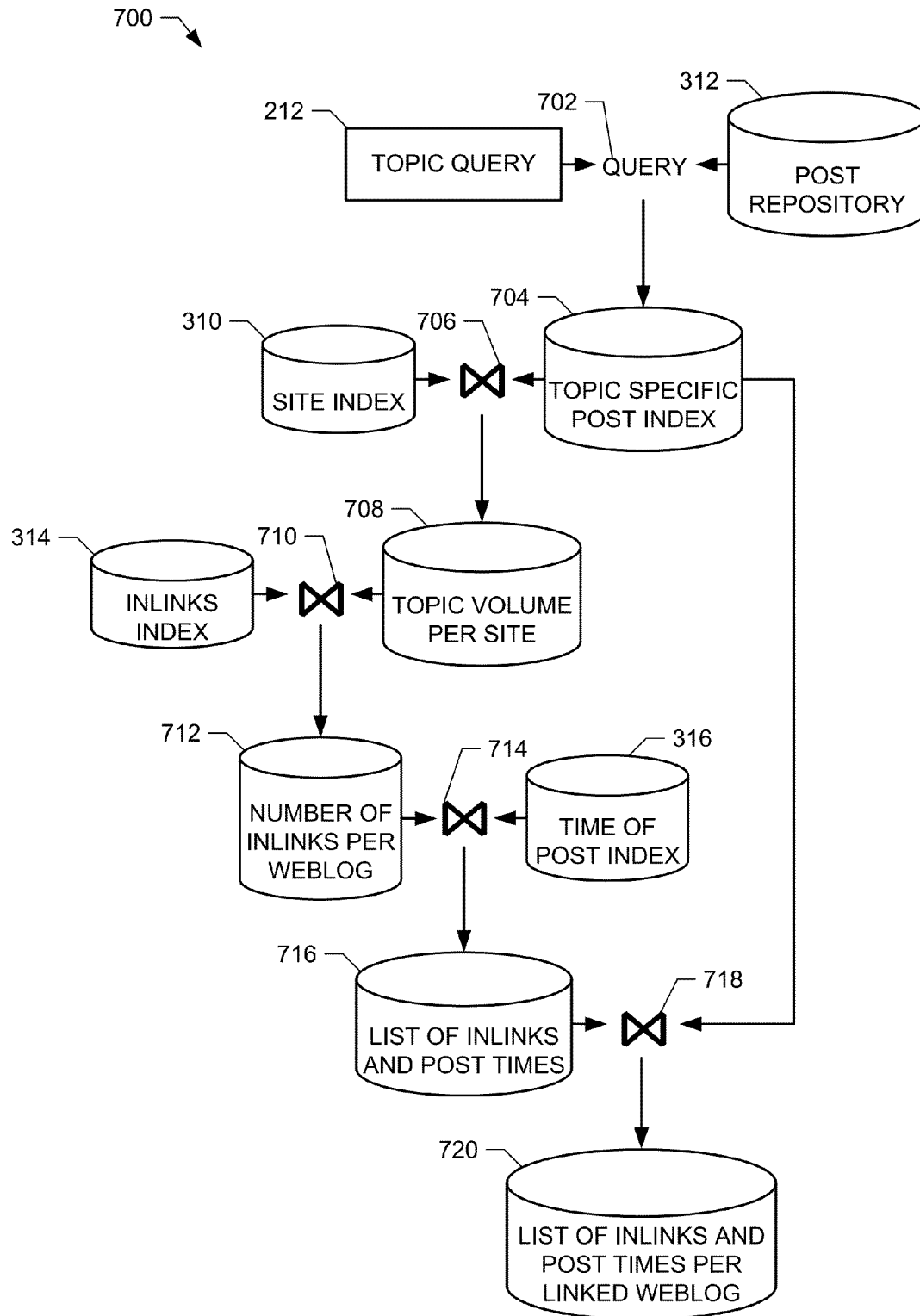


FIG. 7

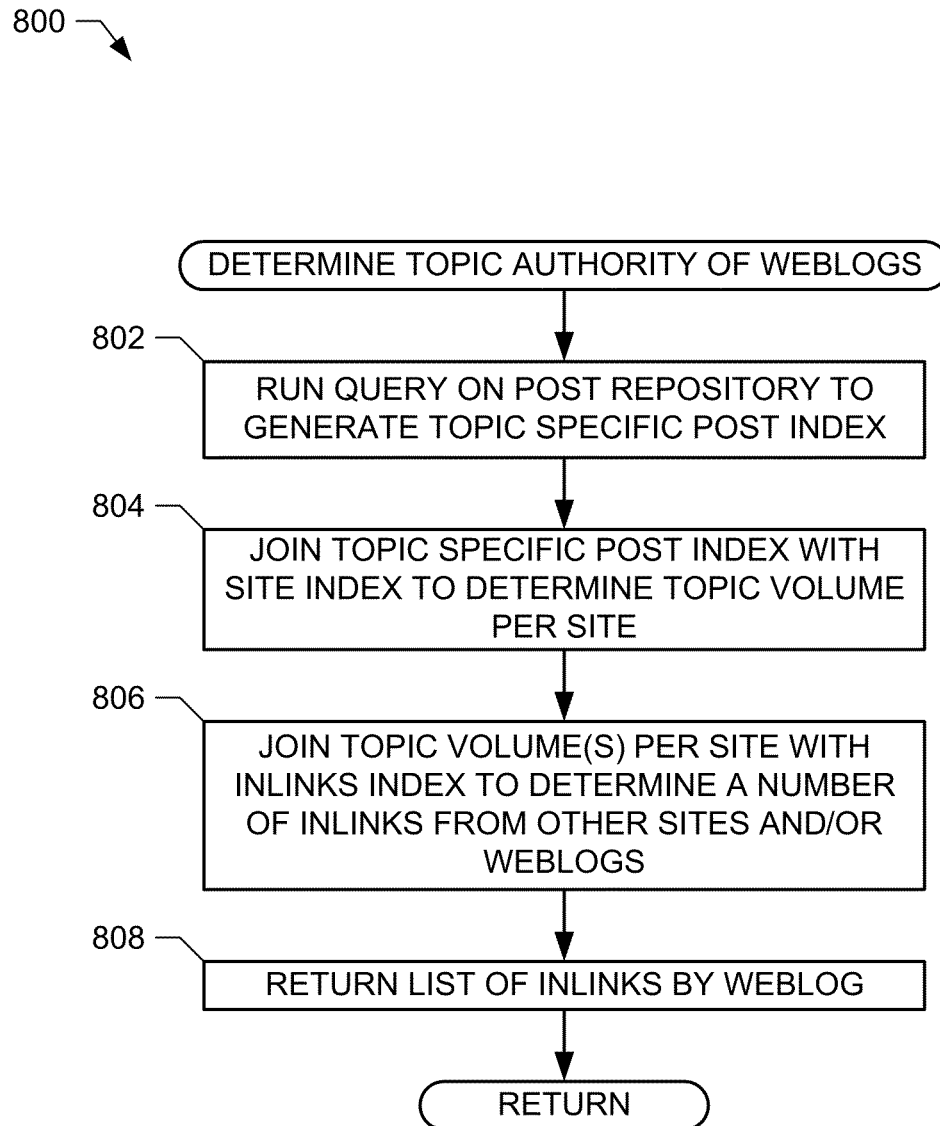


FIG. 8

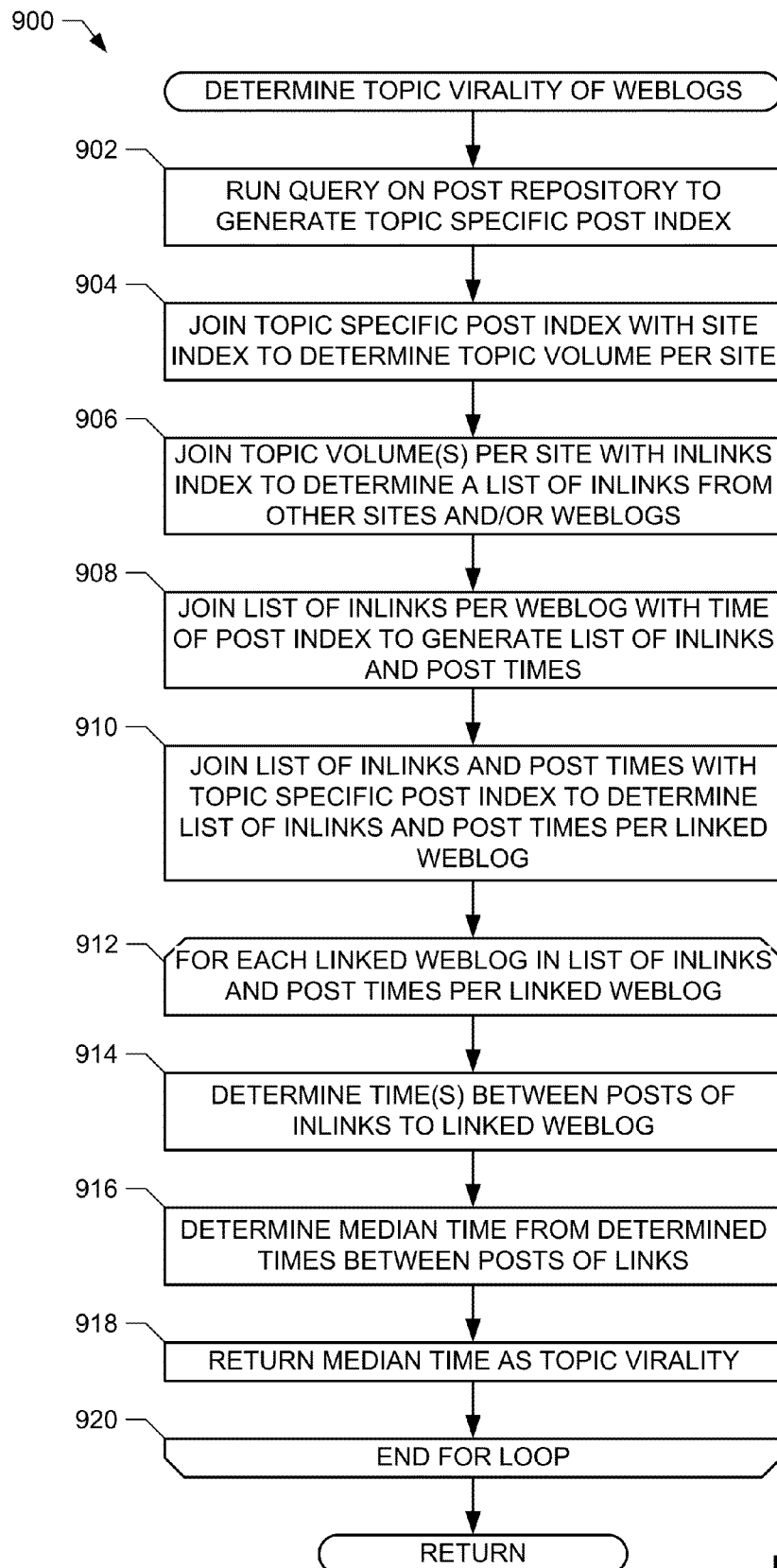


FIG. 9

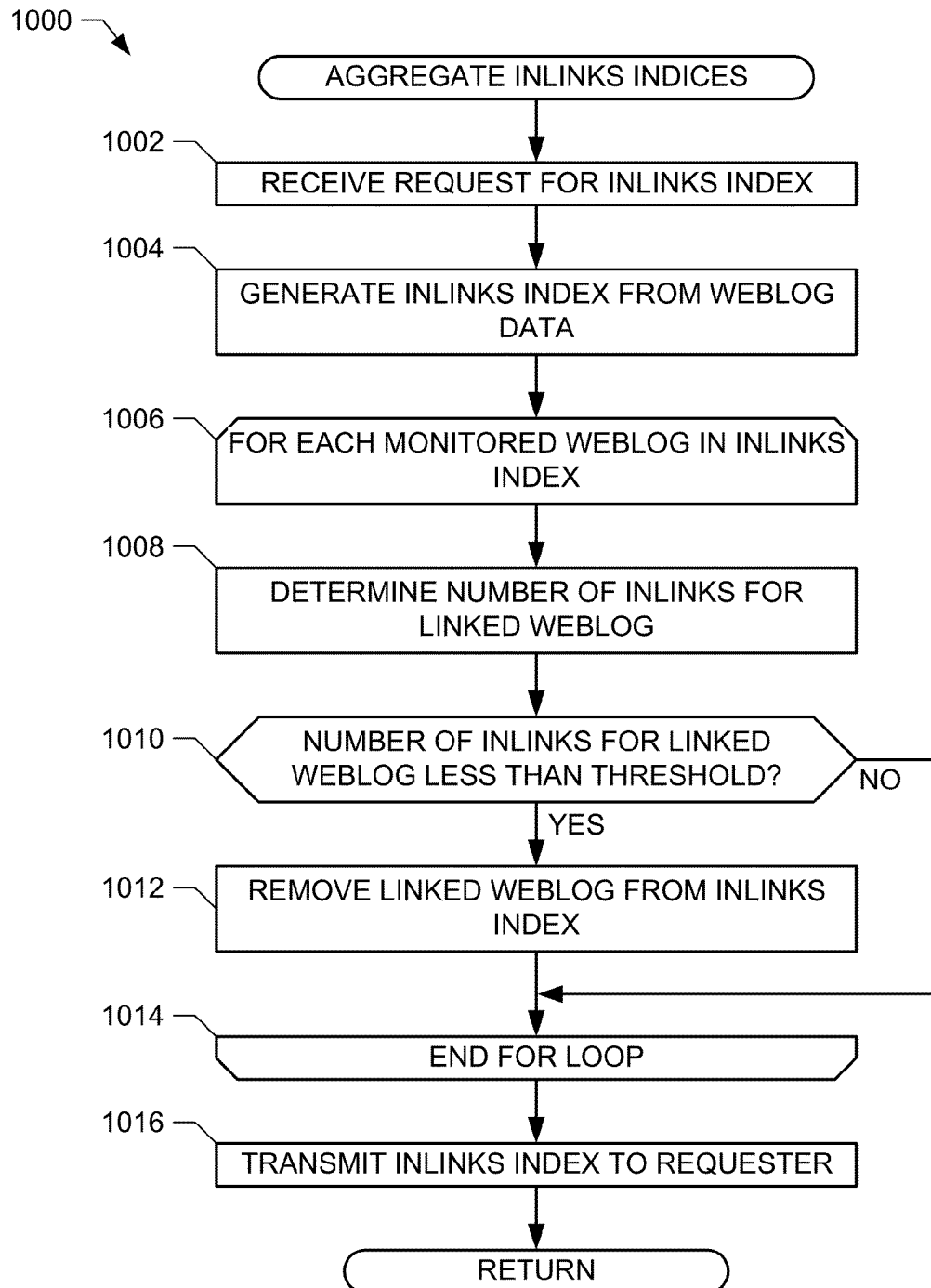


FIG. 10

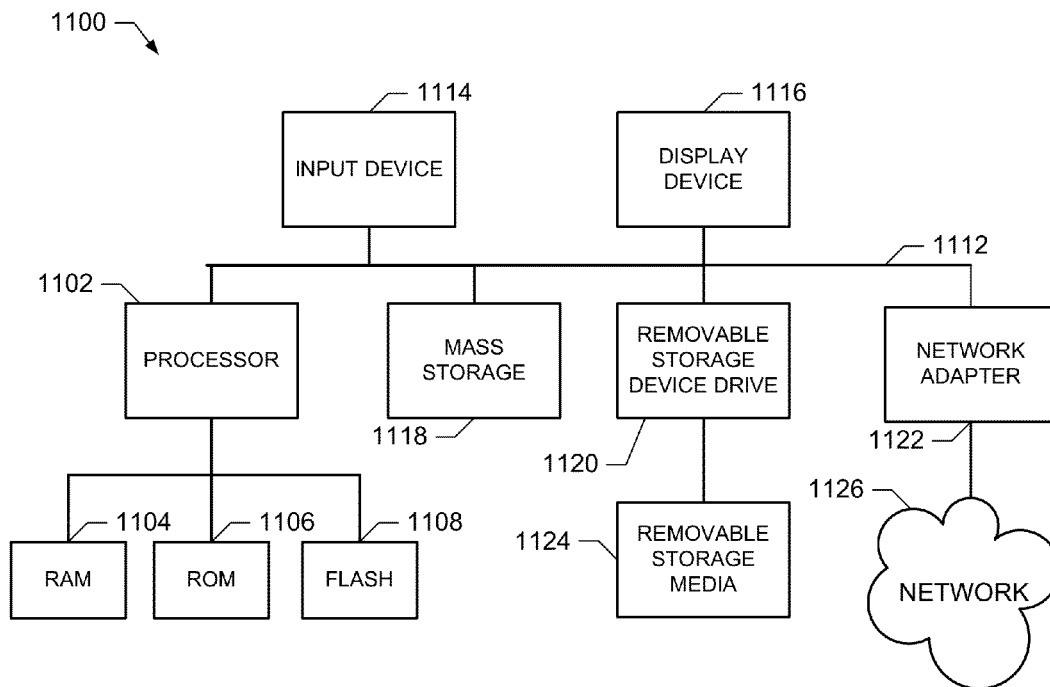


FIG. 11

METHODS, APPARATUS, AND ARTICLES OF MANUFACTURE TO RANK WEB SITE INFLUENCE

RELATED APPLICATIONS

This patent arises from a continuation of U.S. patent application Ser. No. 12/816,159, filed Jun. 15, 2010, and claims priority from U.S. Provisional Application No. 61/345,472, filed May 17, 2010. The entireties of U.S. patent application Ser. No. 12/816,159 and U.S. Provisional Application No. 61/345,472 are incorporated herein by reference.

FIELD OF THE DISCLOSURE

This disclosure relates generally to web site monitoring and, more particularly, to systems, methods, apparatus, and articles of manufacture to rank web site influence.

BACKGROUND

Weblogs, or blogs, refer to online postings maintained by one or more persons who publish content for other online users to view. Weblogs may be maintained by individuals to express their views and opinions about various situations, by organizations to provide a direct connection to their audiences, or by any other person or group for almost any purpose. Weblogs have become a popular medium because of their very low barriers to entry and wide reach. Weblogs have very few, if any, requirements for postings, and weblogs are highly varied in content and style. Many weblogs are focused on a narrow range of subjects, while many other weblogs are directed to a broad range of topics. Also, many weblogs are updated often, while many other weblogs are updated scarcely.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an example system and network to rank the influence of a weblog.

FIG. 2 is a more detailed block diagram of the example system to rank the influence of a weblog shown in FIG. 1.

FIG. 3 is a more detailed block diagram of the example system of FIG. 1.

FIG. 4 is a flowchart representative of example machine readable instructions which may be executed to rank the influence of a weblog.

FIG. 5 is an example data flow that may be implemented by the example systems of FIGS. 2 and 3 to determine a topic volume of a weblog.

FIG. 6 is a flowchart representative of example machine readable instructions which may be executed to determine a topic volume of a weblog.

FIG. 7 is an example data flow that may be implemented by the example systems of FIGS. 2 and 3 to determine a topic authority and/or a topic virality of a weblog.

FIG. 8 is a flowchart representative of example machine readable instructions which may be executed to determine a topic authority of a weblog.

FIG. 9 is a flowchart representative of example machine readable instructions which may be executed to determine a topic virality of a weblog.

FIG. 10 is a flowchart representative of example machine readable instructions which may be executed to aggregate an inlinks index.

FIG. 11 is a diagram of an example processor system that may be used to execute the example machine readable instructions.

DETAILED DESCRIPTION

Although the example systems described herein include, among other components, software executed on hardware, such description is merely illustrative and should not be considered as limiting. For example, it is contemplated that any or all of the disclosed hardware and/or software components could be embodied exclusively in dedicated hardware, exclusively in software, exclusively in firmware or in some combination of hardware, firmware, and/or software.

The example methods, apparatus, and articles of manufacture described herein may be used to measure and/or rank influence of web sites on the Internet, such as weblogs (i.e., “blogs”), based on a particular topic of interest. Some example methods described herein to rank influence of a weblog include determining or measuring four metrics or ranking factors of a weblog, which include topic volume, popularity, topic authority, and topic virality.

In some described examples, topic volume refers to a number of posts (e.g., comments, articles, opinions, submissions) to a weblog that are related to a defined topic. Popularity refers to the number of hits or user accesses (e.g., unique, not unique) to the weblog and may be restricted to a particular time frame. Topic authority refers to a number of inlinks (also known as inbound links and/or backlinks) to the weblog from other web sites (e.g., a number of other web sites and/or weblogs that provide direct or indirect web links which, when activated by a user, load the weblog). Topic virality refers to a median time between inlinks to the weblog from other web sites. Topic authority and topic virality may be based on posts in weblogs and web forums that are relevant to the specified topic.

Some example systems are described as monitoring and ranking topic specific weblogs. In some examples, one or more computer processing systems monitor Internet weblogs, forums, and/or other web sites to record the dates, times, and/or contents of posts. As used herein, the term “post” refers to any statement, question, opinion, article, report, commentary, and/or any other type of submission, typewritten or otherwise, by a web user of a weblog, forum, and/or other web site where the submission is displayed for others to view and/or respond. The monitoring computer processing systems may generate one or more indices of the time, date, and/or contents of posts for later aggregation and/or processing. Additionally, the term “rank” as used herein will refer to a number rank, where a lower number corresponds to a higher or better rank. However, a weblog “rank” may also be directly proportional to a weighted score of the weblog according to one or more ranking factors, where a higher rank corresponds to a higher score.

Example systems may include one or more computer processing systems to measure and/or rank a weblog with respect to a desired topic, based on monitored posts. In some examples, a computer processing system receives a topic and aggregates posts collected by monitoring systems that are relevant to the received topic. The example computer processing systems then determine several ranking factors, including a topic volume of a weblog, a popularity of the weblog, a topic authority of the weblog, and a topic virality of the weblog. In some examples, each of the topic volume, the popularity, the topic authority, and the topic virality are normalized, scored, and/or weighted so that each of the ranking factors has a negative (or positive) relationship to the ranking.

Some example methods to rank the influence of a weblog include receiving a topic term, filtering out a post that is not relevant to the topic term from a first plurality of posts to the weblog, determining a number of inbound links to the weblog based on the topic term, determining a time between the inbound links to the weblog based on the topic term, and generating a rank of the weblog based on the number of inbound links and the time between the inbound links.

Some example apparatus to rank the influence of a weblog are also described, including an authority determiner to determine a number of inbound links to the weblog that are associated with a predetermined topic, a virality determiner to determine a time difference between consecutive links to the weblog from one or more web sites that are associated with the predetermined topic, and a weblog ranker, coupled to the authority determiner and the virality determiner, the weblog ranker to determine a rank of the weblog based on the number of posts, the popularity, the number of links, and the time difference.

Some additional example methods to rank the influence of a weblog are also described, including determining a popularity of the weblog, receiving a topic term, determining a number of posts to the weblog, determining a topic volume based on the topic term and the number of posts to the weblog, determining a topic authority of the weblog based on the topic term and the number of posts to the weblog, determining a topic virality of the weblog based on the topic authority, and determining a rank of the weblog based on the topic authority, the topic virality, the popularity, and the topic volume.

Some examples are described herein that refer to ranking the influence of a weblog. Although the examples use the term “weblog,” the examples are equally applicable to other types of web sites. Accordingly, while some examples described herein refer to ranking the influence of a weblog, the examples are not limited to ranking weblogs. In fact, the example methods, apparatus, and articles of manufacture described herein may be used to rank the influence of any type of weblog, forum, and/or other web site for which factors relevant to an influence rank and/or a topic may be determined.

Weblogs are web sites maintained by bloggers who add and/or update content to the weblogs for consumption by viewers. Weblogs may be maintained by individuals and/or organizations, and many weblogs are directed to a general or particular topic. Forums are also often focused on a particular topic, but differ from weblogs generally by consisting of posts or messages from any user of the forum instead of consisting of posts from selected bloggers as in a weblog. For example, some forums are directed toward question and answer and/or problem and solution formats. However, many different forums are directed to other topics and/or formats.

Some examples described below refer to indices for storing data. As used herein, the term “index” refers to a data structure used to store data, where different indices may be used to store different types of data and the data in different indices may be compared and/or otherwise manipulated. While some example data structures are illustrated below, other data structures may alternatively be used to implement the indices.

FIG. 1 is an example system 100 to rank the influence of a weblog. The example system 100 of FIG. 1 includes one or more weblog monitoring systems 102, 104, and 106, a weblog ranking system 108, and a user terminal 110. The monitoring systems 102-106, the weblog ranking system 108,

and the user terminal 110 are interconnected via a wide area network such as the Internet 112.

Weblogs 114 and 116 and web sites 118 are accessible by the weblog monitoring systems 102-106 via the Internet 112 (e.g., the World Wide Web). The weblogs 114 and 116 and the web site 118 may be loaded by directing a web browser (e.g., Microsoft® Internet Explorer®, Mozilla® Firefox®, etc.) to a server that hosts the weblog 114 or 116 and/or the web site 118 using a Uniform Resource Locator (URL).

Additionally, the weblogs 114 and 116 and/or web sites 118 provide links to other weblogs and/or forums. For example, the content of the weblog 116 includes a link 120 which, when selected by a user of the weblog 116, loads the weblog 114 into the user’s web browser. From the perspective of the weblog 114, the link 120 is considered an inlink. Similarly, the weblog 114 includes a link 121 to the weblog 116 and the web site 118 includes links 122 and 123 to load the weblogs 114 and 116, respectively.

While the example user terminal 110 is illustrated in FIG. 1 as connected to the weblog ranking system 108 via an Internet connection 124, the user terminal 110 may be additionally or alternatively connected to the weblog ranking system 108 via a direct or local connection 126 (e.g., a local area network connection, a client-server connection). A user (not shown) of the system 100 may use the user terminal 110 to request from the weblog ranking system 108 weblog ranking(s) of weblogs 114 and 116 and/or portions of the weblogs 114 and 116 that are pertinent to a topic that is entered by the user. For example, the user may enter a particular topic, for example, in keyword and/or query format.

The example system 100 may further include a popularity monitoring system 128 and/or a search monitoring system 130. The popularity monitoring system 128 determines a popularity of the example weblogs 114 and 116 by determining, for example, the number of unique visitors to each of the weblogs 114 and 116. The search monitoring system 130 monitors behaviors of search users. For example, the search monitoring system 130 may monitor topic(s) searched by users and the weblogs 114 and 116 and/or web sites 118 that are then accessed by users as a result of searching the topic and receiving the search results. In some examples, the search monitoring system 130 further monitors the order in which the users access the weblogs 114 and 116 and/or web sites 118 to determine a likelihood that a user will access a particular weblog 114 and 116 or web site 118 after searching a topic.

FIG. 2 is a block diagram illustrating an example implementation of the weblog ranking system 108 which may be used to rank the influence of a weblog (e.g., the weblog 114 of FIG. 1). The example weblog ranking system 108 includes a volume determiner 202, a virality determiner 206, an authority determiner 204, a popularity determiner 208, and a weblog ranker 210. The weblog ranking system 108 receives a topic query 212 that defines a topic of interest and monitoring data 214, and outputs a weblog rank 216 based on the topic query 212 and the monitoring data 214.

The example weblog ranking system 108 further includes a weblog index 218. The weblog index 218 includes a list of the weblogs 114 and 116 that are monitored by the weblog monitoring systems 102-106 and identifications (IDs) of posts to the weblogs 114. The weblog index 218 may further include an indication of which ones of the weblog monitoring systems 102-106 monitor respective ones of the weblogs 114 and 116. Example contents of the weblog index 218 are illustrated in Table 1.

TABLE 1

WEBLOG ID	POST ID	WEBLOG URL
...
[114]	[1140001], [1140002], [1140003]	www.weblog114.com
[116]	[1160001], [1160002]	www.weblog116.com
...

The example volume determiner **202** receives the topic query **212** (e.g., from the user terminal **110** of FIG. 1), the monitoring data **214** (e.g., from the monitoring systems **102-106** of FIG. 1), and a list of the weblogs **114** and **116** (e.g., from the weblog index **218**). Based on the topic query **212** and the monitoring data **214**, the volume determiner **202** determines a volume of posts that are posted to the weblog **114**. The example volume determiner **202** includes posts that are relevant to the topic query **212** and excludes posts that are not relevant to the topic query **212**. Relevance may be determined using any method, such as including only posts that have all of the words and/or phrases in the topic query **212** and/or including posts that have any of the words and/or phrases in the topic query **212**. The volume determiner **202** provides the volume of posts to the weblog ranker **210**.

The example authority determiner **204** also receives the topic query **212**, the monitoring data **214**, and the list of weblogs **114** and **116**, and determines a topic authority of one or more weblogs. The topic authority of the weblog **114** is the number of inlinks to the weblog **114** from other weblogs and/or web sites. To determine the topic authority of the weblog **114**, the example authority determiner **204** determines the number of inlinks to the weblog by an index of inlinks with a list of posts that are relevant to the topic query **212**. The authority determiner **204** then provides the topic authority of the one or more weblogs **114** to the weblog ranker **210**.

The authority determiner **204** may alternatively determine the topic authority of the weblog **114** by determining a likelihood that a web user will load the weblog **114** in response to a search of the topic query **212** on the World Wide Web (e.g., Google search, Yahoo! search, etc.). For example, the authority determiner **204** may receive and/or determine an ordering in which web users navigate to the weblogs **114** and **116** based on search information received from the search monitoring system **130** of FIG. 1. Example search information may include an audience research panel (e.g., a Nielsen web panel such as a NetRatings panel), search provider statistics, user surveys, and/or another data collection method that provides information on user search habits. The authority determiner **204** may use the ordering as the topic authority of the weblog **114**.

The example virality determiner **206** also receives the topic query **212**, the monitoring data **214**, and the list of weblogs **114** and **116**, and determines a topic virality of one or more weblogs. The topic virality of the weblog **114** is a median time between postings of inlinks to the weblog **114**. Thus, as inlinks to the weblog **114** are posted on other weblogs **116** and/or web sites **118** at a faster rate, the weblog **114** is considered more viral (e.g., the message of the weblog **114** self-replicates and spreads faster). The virality determiner **206** uses the median time between postings of inlinks instead of, for example, the mean time between postings of inlinks because the mean time may be more heavily influenced by outliers in the posting times. In contrast, the median time between postings of inlinks is more likely to accurately represent the virality of different weblogs.

The example popularity determiner **208** determines a popularity of one or more weblogs **114** and **116**. To determine the popularity of the weblog **114**, the popularity determiner **208** determines a number of unique visitors to the weblog **114**. The number of unique visitors may be determined over a particular time period or may be determined over the life of the weblog **114**. In some examples, the popularity may be determined by the example popularity monitoring system **128** of FIG. 1, (e.g., Nielsen NetRatings), and downloaded by the popularity determiner **208**.

The weblog ranker **210** receives the topic volume from the volume determiner **202**, the topic authority from the authority determiner **204**, the topic virality from the virality determiner **206**, the popularity from the popularity determiner **208**, and a list of weblogs from the weblog index **218**. The weblog ranker **210** then scores and/or weights the ranking factors according to predetermined scores and/or weights. For example, the weblog ranker **210** may translate the topic virality from the virality determiner **206** from a median time to a score, where a lower median time results in a higher score. By translating the topic virality to a score, each of the ranking factors has a negative (or positive) relationship to a rank **216** of the weblog **114**. Additionally or alternatively, any set or subset of the topic volume, the topic authority, and/or the popularity may be translated to a score. The translation(s) to score(s) may be based on an absolute or relative range, may have maximum and/or minimum score values, and/or may be weighted by relative importance. Thus, the ranking factors may be summed to determine an overall score, which then determines the rank **216** of the weblog **114** relative to other weblogs **116**.

While the example weblog ranking system **108** of FIG. 2 is illustrated as receiving the topic query **212**, the weblog monitoring data **214**, and the popularity information from the popularity monitoring system **128** separately, the example weblog ranking system **108** may receive the topic query **212**, the weblog monitoring data **214**, the popularity information from the popularity monitoring system **128**, and the search information from the search monitoring system **130** via one or more physical and/or virtual connections to an external network such as the Internet **112** of FIG. 1. Similarly, the weblog ranking system **108** may output the weblog rank(s) **216** via any one or more physical and/or virtual connections to a system user (e.g., a user of the user terminal **110** of FIG. 1). For example, the weblog ranking system **108** may receive the topic query **212** from the user terminal **110**, the weblog monitoring data **214** from the monitoring system **102-106**, the popularity information from the popularity monitoring system **128**, and/or the search information from the search monitoring system **130** may be received via a single Ethernet connection using different ports. The weblog ranking(s) **216** may further be output via the Ethernet connection on one of the same ports or a different port as the input information.

FIG. 3 is a block diagram illustrating an example monitoring system **300** to monitor weblogs and web sites for posts. The example monitoring system **300** may be used to implement any of the monitoring systems **102-106** of FIG. 1 to monitor weblogs, forums, and/or other web sites for posts. The monitoring system **300** of FIG. 3 includes a web site monitor **302**, a post updater **304**, an inlinks updater **306**, and a time of post updater **308**. The monitoring system **300** maintains several databases and/or indices, including a weblog/web site index **310**, a post repository **312**, an inlinks index **314**, and a time of post index **316**. Additionally, the monitoring system **300** includes an inlink remover **318** to remove inlinks from the inlinks index **314** as described below and a

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data aggregator **320** to aggregate data and to forward data to a weblog ranking system (e.g., the weblog ranking system **108** of FIG. 1).

The web site monitor **302** monitors one or more weblogs (e.g., the weblogs **114** and **116** of FIG. 1) and/or other web sites (e.g., the web sites **118** of FIG. 1). The weblogs **114** and **116** and/or web sites monitored by the web site monitor **302** may be determined by accessing the weblog/web site index **310**. Each of the monitoring systems **102-106** has different weblogs and/or web sites included in its respective weblog/web site index **310**, thereby causing each monitoring system **102-106** to monitor a different set of weblogs **114** and **116** and/or web sites **118**. The weblogs **114** and **116** and/or web sites **118** may be distributed between the monitoring systems **102-106** in any appropriate manner to increase the performance of the weblog ranking system **108**. The example weblog/web site index **310** therefore includes fields illustrated below in Table 2. While the example fields in Table 2 are similar to those in Table 1 (e.g., the weblog index **218**), the example weblog/site index **310** may include forum(s) **118** and other web sites in addition to weblogs because the weblog/site index **310** is used to determine which weblogs **114** and **116** and/or web sites **118** are monitored by the example monitoring system **300**.

TABLE 2

WEBLOG/SITE ID	WEBLOG/SITE URL
...	...
[114]	www.weblog114.com
[116]	www.weblog116.com
[118]	www.forum118.com
...	...

When the web site monitor **302** receives an indication of a weblog or web site (e.g., the weblog **114**), the web site monitor **302** accesses a web server to download the most recent version of the weblog **114** to determine whether any updated content is available. The content of the downloaded weblog **114** is then processed by the post updater **304** to update the post repository **312**. The post updater **304** extracts the content of any new posts to the weblog **114**, such as keywords, and indexes the post contents in the post repository **312**. Example alternative sets of fields used in the post repository **312** are illustrated below as Tables 3a and 3b. As illustrated in Table 3a, each post includes a unique POST ID by which a post may be identified and distinguished from other posts to the same weblog and/or other weblogs. In contrast, Table 3b is arranged by keyword, with the POST ID of each post that includes the keyword included in the POST ID field. However, using the arrangement of Table 3b requires an additional table to match each POST ID to a WEBLOG/SITE ID.

TABLE 3a

POST ID	POST CONTENTS	WEBLOG/SITE ID
...
[1140001]	keyword1, key2, keyword3	[114]
[1140002]	key2, keyword4, key6	[114]
[1140003]	key2, keyword4	[114]
[1160001]	keyword7, key2, keyword4	[116]
[1160002]	key2, keyword4, key8	[116]
[1180001]	key2, keyword4, keyword9	[118]
...

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TABLE 3b

KEYWORD	POST ID
...	...
keyword1	[1140001]
key2	[1140001], [1140002], [1140003], [1160001], [1160002], [1180001]
keyword4	[1140002], [1140003], [1160001], [1160002], [1180001]
key6	[1140002]
...	...

The inlinks updater **306** also processes the content of the downloaded weblog **114** to determine whether any links to other weblogs are present. For example, a news weblog may cite and link to another weblog as a source of the information presented in a post on the news weblog. The inlinks are indexed by the inlinks updater **306** to update the inlinks index **314**. An example inlinks index **314**, as illustrated below in Table 4, may be a list of the posts to which each of the posts in the example post repository **312** links. While Table 4 is organized by LINKING POST ID (e.g., the post where a link to another post or weblog is posted), the example inlinks index **314** may alternatively be organized by LINKED POST ID, where the LINKING POST ID would then include the list of posts that link to the LINKED POST ID. The POST ID [1180001] below is illustrated in the example inlinks index **314** and is not illustrated in the example post repository **312** above because the post repository **312** includes the contents of those posts that are posted to weblogs **114** and **116** that may be ranked by the weblog ranking system **108** of FIG. 1.

TABLE 4

LINKING POST ID	LINKED POST ID
...	...
[1140001]	null
[1140002]	[1160001]
[1140003]	[1160001]
[1160001]	[1140001]
[1160002]	[1140001]
[1180001]	[1140001], [1160001]
...	...

Additionally, the time of post updater **308** determines the time(s) of any new post(s) to the weblog **114**. The time of post updater **308** then stores the times of the posts in the time of post index **316**. An example time of post index **316** is illustrated in Table 5. The example time of post index **316** is organized by POST ID, and includes a corresponding POST TIME at which the post was posted and/or observed by the web site monitor **302**. The example POST TIME field is shown in a MM/DD/YYYY:hh:mm:ss 24-hour format. However, other formats and/or granularities of the time of posts may be used to reduce the size of the time of post index and/or to increase accuracy.

TABLE 5

POST ID	POST TIME
...	...
[1140001]	01/01/2010:08:00:00
[1140002]	01/02/2010:15:30:30
[1140003]	03/20/2010:21:56:59
[1160001]	01/02/2010:09:10:10
[1160002]	01/15/2010:20:20:00
[1180001]	02/28/2010:12:00:00
...	...

In the illustrated example, the indexed post contents in the post repository 312, the indexed inlinks in the inlinks index 314, and the indexed times of posts in the time of post index 316 include indicators of which post in which weblog 114 or 116 they originated, thereby correlating corresponding post contents, inlinks, and times for later processing.

When the weblog ranking system 108 ranks a weblog, the weblog ranking system 108 requests data from the example weblog monitoring system 300. Accordingly, the data aggregator 320 receives a request from the weblog ranking system 108 for weblog monitoring data that has been collected by the weblog monitoring system 300. In some examples, the weblog ranking system 108 includes in its request a topic query (e.g., the topic query 212 of FIG. 2).

The topic query 212 is received by the data aggregator 320 and is used to narrow the number of posts that are returned to the weblog ranking system 108. For example, the data aggregator 320 applies the topic query to the post repository 312. As a result, the data aggregator 320 determines a subset of the posts in the post repository 312. The subset is used to pull the inlinks and the times of the posts from the inlinks index 314 and the times of posts index 316, respectively, that correspond to the subset of posts based on the topic query. The data aggregator 320 may then transmit the posts, including the respective inlinks and the times of the posts, belonging to the subset corresponding to the topic query to the weblog ranking system 108. Additionally or alternatively, the data aggregator 320 may transmit indices of the posts (e.g., identifying information for the posts) to increase communications, processing, and/or storage efficiency.

The inlink remover 318 may further filter the number of posts sent to the weblog ranking system 108 by the data aggregator 320 by removing or filtering inlinks from the inlinks index 314 that occur less than a predetermined number of times. By reducing the number of inlinks, the speed of data transfer may be increased to improve the responsiveness of a query. The removal of inlinks from the inlinks index 314 may temporarily mask the filtered inlinks from the data aggregator 320 for a particular topic query or may delete the filtered inlinks from the inlinks index 314 for later queries.

While example manners of implementing the example system 100 of FIG. 1 has been illustrated in FIGS. 2 and 3, one or more of the elements, processes and/or devices illustrated in FIGS. 2 and/or 3 may be combined, divided, re-arranged, omitted, eliminated and/or implemented in any other way. Further, the example volume determiner 202, the example virality determiner 206, the example authority determiner 204, the example popularity determiner 208, the example weblog ranker 210, the example web site monitor 302, the example post updater 304, the example inlinks updater 306, the example time of post updater 308, the example inlinks remover 318, the example data aggregator 320 and/or, more generally, the example weblog ranking system 108 of FIG. 2 and/or the example weblog monitoring system 300 of FIG. 3 may be implemented by hardware, software, firmware and/or any combination of hardware, software and/or firmware. Thus, for example, any of the example volume determiner 202, the example virality determiner 206, the example authority determiner 204, the example popularity determiner 208, the example weblog ranker 210, the example web site monitor 302, the example post updater 304, the example inlinks updater 306, the example inlinks remover 318, the example data aggregator 320 and/or, more generally, the example weblog ranking system 108 of FIG. 2 and/or the example weblog monitoring system 300 of FIG. 3 could be implemented by one or more circuit(s), programmable processor(s), application specific

integrated circuit(s) (ASIC(s)), programmable logic device(s) (PLD(s)) and/or field programmable logic device(s) (FPLD(s)), etc.

As used herein, the term tangible computer readable medium is expressly defined to include any type of computer readable storage and to exclude propagating signals. Additionally or alternatively, the example processes of FIGS. 4-10 may be implemented using coded instructions (e.g., computer readable instructions) stored on a non-transitory computer readable medium such as a flash memory, a read-only memory (ROM), a random-access memory (RAM), a cache, or any other storage media in which information is stored for any duration (e.g., for extended time periods, permanently, brief instances, for temporarily buffering, and/or for caching of the information). As used herein, the term non-transitory computer readable medium is expressly defined to include any type of computer readable medium and to exclude propagating signals. When any of the appended apparatus claims are read to cover a purely software and/or firmware implementation, at least one of the example volume determiner 202, the example virality determiner 206, the example authority determiner 204, the example popularity determiner 208, the example weblog ranker 210, the example web site monitor 302, the example post updater 304, the example inlinks updater 306, the example time of post updater 308, the example inlinks remover 318, and/or the example data aggregator 320 are hereby expressly defined to include a tangible medium such as a memory, DVD, CD, etc. storing the software and/or firmware. Further still, the example volume determiner 202, the example virality determiner 206, the example authority determiner 204, the example popularity determiner 208, the example weblog ranker 210, the example web site monitor 302, the example post updater 304, the example inlinks updater 306, the example time of post updater 308, the example inlinks remover 318, the example data aggregator 320 and/or, more generally, the example weblog ranking system 108 of FIG. 2 and/or the example weblog monitoring system 300 of FIG. 3 may include one or more elements, processes and/or devices in addition to, or instead of, those illustrated in FIGS. 2 and 3, and/or may include more than one of any or all of the illustrated elements, processes and devices.

FIG. 4 is a flowchart representative of example machine readable instructions 400 which may be executed to rank the influence of a weblog (e.g., the example weblog 114 of FIG. 1). The instructions 400 may be executed by the weblog ranking system 108 of FIG. 3. The instructions 400 begin by receiving a topic from, for example, a user wishing to know the most influential weblogs related to the topic (block 402).

The weblog ranking system 108 determines a topic volume of weblogs in a weblog index (block 404). Block 404 is described in more detail below with reference to FIGS. 5 and 6. The weblog ranking system 108 further determines the popularity of weblogs in the weblog index 218 (block 406).

To prepare for determining the topic authority and topic virality, the weblog ranking system 108 aggregates the inlinks indices (block 408). For example, the weblog ranking system 108 may instruct the weblog monitoring systems 102-106 to aggregate and transmit posts relevant to the topic query 212 to the weblog ranking system 108. The posts may be further filtered by posting date and/or lower limit on inlinks for the weblog associated with a post. When the posts have been aggregated and transmitted to the weblog ranking system 108, the weblog ranking system 108 determines the topic authority of the weblogs in the weblog index (block 410). The topic authority may be based on the topic query 212 and the aggregated posts.

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The weblog ranking system **108** (e.g., via the virality determiner **206**) further determines the topic virality of the weblogs in the weblog index (block **412**). The topic virality may be determined based on the topic authority of the weblogs because the topic authority is based on the inlinks to the weblogs and the topic virality is based on times between postings of the inlinks used to determine the topic authority.

When the weblog ranking system **108** has determined the topic volume (block **404**), the popularity (block **406**), the topic authority (block **410**), and the topic virality (block **412**) of the one or more weblogs, the weblog ranking system **108** (e.g., via the weblog ranker **210**) determines the rank (e.g., the weblog rank **216** of FIG. 2) of one or more of the weblogs **114** (block **414**). For example, the weblog ranker **210** weights the values of the topic volume, the popularity, the topic authority, and the topic virality and adds the weighted values to determine a score. In some examples, the topic virality is converted to a score, where a lower median time between postings of inlinks results in a higher score. When using a score for the topic virality, each of the topic volume, the popularity, the topic authority, and the topic virality score causes a better rank as the value of the factor increases. To rank a weblog (block **414**), the weblog ranker **200** determines the total weighted values of at least two weblogs (e.g., the weblogs **114** and **116**) and then compares the total weighted values of the weblogs **114** and **116** to determine the rank of each.

The weights used by the weblog ranker **210** may be modified to emphasize one or more of the topic volume, the popularity, the topic authority, and the topic virality. For example, popularity of a weblog may be emphasized (e.g., by increasing the weight relative to the other weights) when the topic query **212** is in an area that is heavily user- or popularity-driven. In another example, the topic virality may be emphasized when the user wishes to know the rankings of weblogs over a time period shortly following a particular event.

FIG. 5 is an example data flow **500** that may be implemented by the example systems of FIGS. 2 and 3 (e.g., via the volume determiner **202**) to determine a topic volume of a weblog (e.g., the weblog **114** of FIG. 1). The example data flow **500** will be described with reference to the instructions **600** illustrated in FIG. 6. The flowchart illustrated in FIG. 6 is representative of example machine readable instructions **600** that may be executed to determine a topic volume of a weblog. The topic volume of the weblog, as described above, refers to a number of posts in the weblog that contain or are directed to a particular topic.

The example instructions **600** may begin by running **502** (e.g., applying) a topic query (e.g., the topic query **212** of FIG. 2) to a post repository (e.g., the example post repository **312** of FIG. 3) to generate a topic specific post index **504** (e.g., filter the records in the post repository **312**) (block **602**). The topic specific post index **504** includes the list of posts from the post repository **312** that are related to the topic query **212**. An example topic specific post index **504**, resulting from the application **502** of the topic query **212** to the post repository **312**, includes data fields similar or identical to those of the post repository **312** as illustrated in Tables 3a and/or 3b above.

The example query operation **502** of FIG. 5 identifies entries in the post repository **312** that include the terms in the topic query **212**. The query operation **502** may identify only those entries that include all of the terms in the topic query **212** or may identify any entries that include at least one of the terms in the topic query **212**. However, the query operation **502** may be used to identify entries in the post repository **312** that have a minimum relevance score (e.g., meet a lower threshold of terms in the topic query **212**).

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The example compare operations **506**, **706**, **710**, **714**, and **718** described below are illustrated as natural join operations (\bowtie) in FIGS. 5 and 7, but other comparison operations may be used. As used herein, the term “join” generally refers to the natural join mathematical operation between two sets (e.g., indices, tables, etc.) that results in another set that includes the combinations of tuples in the two sets that are equal or substantially equal on their common attributes. In some examples, other types of join operations may be used to achieve a desired result set. Additionally, joins may be performed on fields that do not have identical field names (e.g., joining Table₁₃.3a.[POST ID] on Table₄.[LINKING POST ID]). Additionally or alternatively, any type of appropriate set operation(s), logic operation(s), and/or other data operation(s) may be used to perform the comparisons **506**, **706**, **710**, **714**, and **718**.

The example volume determiner **202** compares **506** the topic specific post index **504** to a weblog index (e.g., the weblog index **218** of FIG. 2) to determine a topic volume per weblog **508** (block **604**). The weblog index **218** is a list of the weblog to which each post in the post repository belongs. Thus, the compare **506** at block **604** generates a list of the number of posts for each weblog in the weblog index **218**, which is used as the topic volume per weblog. The volume determiner **202** returns the topic volume per weblog **508** to the weblog ranker **210**. An example topic volume per weblog **508** is illustrated below in Table 6, where the topic query **212** includes the keywords “key2,keyword4,” and the keywords are combined in an AND operation. Of course, the topic query **212** may support any type of Boolean query including, but not limited to, the AND, OR, and/or NOT Boolean operators.

TABLE 6

WEBLOG ID	POST ID
...	...
[114]	[1140002], [1140003]
[116]	[1160001], [1160002]
...	...

FIG. 7 is an example data flow **700** that may be implemented by the example systems of FIGS. 2 and 3 to determine a topic authority and/or a topic virality of a weblog (e.g., the weblog **114** of FIG. 1). The example data flow **700** will be described with reference to example machine readable instructions **800** and **900** of FIGS. 8 and 9. FIG. 8 is a flowchart representative of example machine readable instructions **800** which may be executed to determine a topic authority of the weblog **114**. The authority determiner **204** of FIG. 2 may be used to implement the example instructions **800**. FIG. 9 is a flowchart representative of example machine readable instructions **900** which may be executed to determine a topic virality of the weblog **114**. The virality determiner **206** of FIG. 2 may be used to implement the example instructions **900**.

The example instructions **800** begin by running (e.g., via the volume determiner **202** or the authority determiner **204** of FIG. 2) the topic query **212** on the post repository **312** (e.g., a query **702**) to generate a topic specific post index **704** (block **802**). As described above, the topic specific post index **704** is a list of the posts in the post repository **312** that belong to the monitored weblogs and may have fields similar or identical to those of the example post repository **312** illustrated in Table 3a or 3b. Block **802** is similar to block **602** of FIG. 6. The authority determiner **204** then compares **706** the topic specific post index **704** to the web site index **310** to generate a topic volume per site **708** (block **804**). In contrast to the weblog

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index **218** used, the web site index **310** includes other sites (e.g., the web site **118** of FIG. 1) in addition to weblogs (e.g., the weblogs **114** and **116** of FIG. 1). The example topic volume per site **708** may include fields similar or identical to those illustrated in Table 6 above.

The authority determiner **204** compares **710** the topic volume per site **708** to the inlinks index **314** to generate a list of inlinks per weblog **712** (block **806**). As described above, the inlinks index **314** is a list of inlinks to weblogs and an indicator of the post and/or web site to which each inlink belongs. The comparison **710** of the inlinks index **314** to the topic volume per site **708** (e.g., the posts relevant to the topic query **212**) results in the number of inlinks per weblog that are relevant to the topic query **212**. Thus, inlinks to a weblog that are not relevant to the topic query **212** are excluded. An example list of inlinks per weblog is illustrated below in Table 7. The authority determiner **204** then outputs or returns the list of inlinks per weblog **712** to the weblog ranker **210** as the topic authority (block **808**). Control may then return to block **412** of FIG. 4 to determine topic virality (e.g., the instructions **900** of FIG. 9).

TABLE 7

WEBLOG ID	LINKING POST ID
...	...
[114]	[1160001], [1160002], [1180001]
[116]	[1140002], [1140003], [1180001]
...	...

Blocks **902**, **904**, and **906** of FIG. 9 are substantially identical to respective blocks **802**, **804**, and **806** of FIG. 8. Accordingly, if the instructions **800** are executed prior to the execution of the instructions **900** (e.g., block **410** of FIG. 4 is executed prior to block **412**), execution of blocks **902**, **904**, and **906** may be omitted for processing efficiency. For example, after the authority determiner **204** determines the list of inlinks per weblog **712**, the authority determiner **204** may pass the list of inlinks per weblog **712** to the virality determiner **206** in addition to the weblog ranker **210**. At block **908**, the virality determiner **206** compares **714** the list of inlinks per weblog **712** to the time of post index **316** to generate a list of inlinks and corresponding post times **716**. Thus, the list of inlinks and post times **716** includes the times at which topic specific inlinks were posted on a weblog or other web site. An example list of inlinks and post times **716** is illustrated below in Table 8.

TABLE 8

LINKING POST ID	LINKED POST ID	POST TIME
...
[1140002]	[1160001]	01/02/2010:15:30:30
[1140003]	[1160001]	03/20/2010:21:56:59
[1160001]	[1140001]	01/02/2010:09:10:10
[1160002]	[1140001]	01/15/2010:20:20:00
[1180001]	[1140001], [1160001]	02/28/2010:12:00:00
...

The virality determiner **206** then compares **718** the list of inlinks and post times **716** to the topic specific post index **704** to generate a list of inlinks and post times per linked weblog **720**. The example comparison **718** causes inlinks to topic-specific weblogs **114** and **116** to be discarded if the inlinks are not posted in topic specific posts. Thus, the example method **900** ranks topic-specific influence of a weblog **114** or **116** based on virality within other topic-specific weblogs **114** and

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116 and/or web sites **118**. An example list of inlinks and post times per linked weblog **720** is illustrated below in Table 9. As shown in Table 9, the example POST IDs may be arranged chronologically according to the corresponding POST TIME value.

TABLE 9

WEBLOG ID	LINKING POST ID	POST TIME
...
[114]	[1160001],	01/02/2010:09:10:10,
	[1160002],	01/15/2010:20:20:00,
	[1180001]	02/28/2010:12:00:00
[116]	[1140002],	01/02/2010:15:30:30,
	[1180001],	02/28/2010:12:00:00,
	[1140003]	03/20/2010:21:56:59
...

Using the list of inlinks and post times per linked weblog **720**, the virality determiner **206** determines the virality of each linked weblog. The virality determiner **206** begins a loop by selecting a linked weblog in the list of inlinks and post times per linked weblog **720** (block **912**). For the selected linked weblog, the virality determiner **206** determines the time(s) between posts of inlinks to the linked weblog (e.g., based on the inlinks and post times in the inlinks and post times per linked weblog **720**) (block **914**). From the determined time(s), the virality determiner **206** determines the median time (block **916**). The virality determiner **206** then returns the median time as the topic virality of the selected linked weblog (block **918**). In the described example, a weblog has a higher topic virality as the median time between posts decreases. The virality uses the median time to reduce or eliminate the effect of outlier times between posts. The virality determiner **206** then either iterates the loop at block **920** or, if the topic virality has been determined for the linked weblogs in the inlinks and post times per linked weblog **720**, the loop may end at block **920**. Control may then return to block **414** of the instructions **400** of FIG. 4.

FIG. 10 is a flowchart representative of example machine readable instructions **1000** that may be executed to aggregate an inlinks index (e.g., the inlinks index **314** of FIG. 3). The instructions **1000** may be executed by, for example, the weblog monitoring system **300** of FIG. 3 in response to a request for a list of inlinks from the weblog ranking system **108** of FIG. 1. By executing the instructions **1000**, the processing time for ranking a weblog based on a topic may be significantly reduced.

The weblog monitoring system **300** receives a request for a list of inlinks (e.g., from the weblog ranking system **108** of FIG. 1) (block **1002**). The weblog monitoring system **300** (e.g., via the web site monitor **302** and the inlinks updater **306**) generates an inlinks index (e.g., the inlinks index **314** of FIG. 3) (block **1004**). In some examples, the inlinks index **314** may be generated and/or updated prior to receiving the request for the list of inlinks to further reduce processing time. As described above, the inlinks index **314** includes an indicator of the weblog to which each inlink links.

Block **1006** begins a loop to process the weblogs in the inlinks index **314** by selecting a linked weblog from the inlinks index **314**. The weblog monitoring system **300** (e.g., via the inlinks remover **318**) determines the number of inlinks for the linked weblog (block **1008**). The inlinks remover **318** determines whether the number of inlinks is less than a lower threshold (block **1010**). If the number of inlinks is less than the threshold (block **1010**), the inlinks remover **318** removes the linked weblog and/or the inlinks to the linked weblog

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from the inlinks index 314 (block 1012). After removing the linked weblog and/or the inlinks (block 1012), or if the number of inlinks is greater than or equal to the threshold (block 1010), the inlinks remover 318 iterates or ends the loop (block 1014). If there are additional linked weblogs to be evaluated, the loop iterates at block 1006. When the loop has ended (block 1014), the weblog monitoring system 300 transmits the inlinks index 314 (as modified by the inlinks remover 318) to the requesting system, such as the weblog ranking system 108.

FIG. 11 is a diagram of an example processor system 1100 that may be used to execute the example machine readable instructions 400, 600, 800, 900, and 1000 described in FIGS. 4, 6, 8, 9, and 10, as well as to implement the weblog ranking system 108 and/or the weblog monitoring system 300 described in FIGS. 2 and 3. The example processor system 1100 includes a processor 1102 having associated memories, such as a random access memory (RAM) 1104, a read only memory (ROM) 1106 and a flash memory 1108. The processor 1102 is coupled to an interface, such as a bus 1112 to which other components may be interfaced. In the illustrated example, the components interfaced to the bus 1112 include an input device 1114, a display device 1116, a mass storage device 1118, a removable storage device drive 1120, and a network adapter 1122. The removable storage device drive 1120 may include associated removable storage media 1124 such as magnetic or optical media. The network adapter 1122 may connect the processor system 1100 to an external network 1126.

The example processor system 1100 may be, for example, a conventional desktop personal computer, a notebook computer, a workstation or any other computing device. The processor 1102 may be any type of processing unit, such as a microprocessor from the Intel® Pentium® family of microprocessors, the Intel® Itanium® family of microprocessors, and/or the Intel XScale® family of processors. The memories 1104, 1106 and 1108 that are coupled to the processor 1102 may be any suitable memory devices and may be sized to fit the storage demands of the system 1100. In particular, the flash memory 1108 may be a non-volatile memory that is accessed and erased on a block-by-block basis.

The input device 1114 may be implemented using a keyboard, a mouse, a touch screen, a track pad, a barcode scanner or any other device that enables a user to provide information to the processor 1102.

The display device 1116 may be, for example, a liquid crystal display (LCD) monitor, a cathode ray tube (CRT) monitor or any other suitable device that acts as an interface between the processor 1102 and a user. The display device 1116 as pictured in FIG. 8 includes any additional hardware required to interface a display screen to the processor 1102.

The mass storage device 1118 may be, for example, a conventional hard drive or any other magnetic, optical, or solid state media that is readable by the processor 1102.

The removable storage device drive 1120 may, for example, be an optical drive, such as a compact disk-recordable (CD-R) drive, a compact disk-rewritable (CD-RW) drive, a digital versatile disk (DVD) drive or any other optical drive. It may alternatively be, for example, a magnetic media drive and/or a solid state universal serial bus (USB) storage drive. The removable storage media 1124 is complimentary to the removable storage device drive 1120, inasmuch as the media 1124 is selected to operate with the drive 1120. For example, if the removable storage device drive 1120 is an optical drive, the removable storage media 1124 may be a CD-R disk, a CD-RW disk, a DVD disk or any other suitable optical disk. On the other hand, if the removable storage

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device drive 1120 is a magnetic media device, the removable storage media 1124 may be, for example, a diskette or any other suitable magnetic storage media.

The network adapter 1122 may be, for example, an Ethernet adapter, a wireless local area network (LAN) adapter, a telephony modem, or any other device that allows the processor system 1100 to communicate with other processor systems over a network. The external network 1126 may be a LAN, a wide area network (WAN), a wireless network, or any type of network capable of communicating with the processor system 1100. Example networks may include the Internet, an intranet, and/or an ad hoc network.

Accordingly, while the above specification described example systems, methods and articles of manufacture, the examples are not the only way to implement such systems, methods and articles of manufacture. Therefore, although certain example methods, apparatus and articles of manufacture have been described herein, the scope of coverage of this patent is not limited thereto. On the contrary, this patent covers all methods, apparatus and articles of manufacture fairly falling within the scope of the appended claims either literally or under the doctrine of equivalents.

What is claimed is:

1. A method to rank the influence of a web site, comprising:
 - accessing a query based on a topic term;
 - determining, using a processor, topic specific posts by applying the query to a first plurality of posts to a web site;
 - comparing, using the processor, the topic specific posts to a list of web sites to determine a topic volume per site;
 - determining, using the processor, a plurality of inbound links to the first plurality of posts;
 - determining, using the processor, a number of inbound links to the posts that are relevant to the topic term by comparing the topic volume per site and the inbound links; and
 - generating, using the processor, a rank of the web site based on the number of inbound links to the posts that are relevant to the topic term and times between the inbound links.
2. A method as defined in claim 1, further comprising calculating elapsed times between postings of adjacent ones of the inbound links by:
 - determining posting times of posts that are relevant to the topic term;
 - comparing the posting times to the inbound links to determine a first list of inbound links and posting times of the inbound links; and
 - comparing the posting times of the inbound links to the topic specific posts to generate a second list of (1) inbound links, (2) posting times, and (3) posts associated with the inbound links and the posting times.
3. A method as defined in claim 2, further comprising calculating a median elapsed time by removing an outlier from the list of (1) the inbound links, (2) the posting times, and (3) the posts associated with the inbound links and the posting times.
4. A method as defined in claim 2, wherein the comparing comprises a join operation.
5. A method as defined in claim 1, further comprising receiving at least a portion of the plurality of inbound links from a web site monitor.
6. A method as defined in claim 5, wherein the received portion of the plurality of inbound links comprises posts having a number of inbound links that is greater than a threshold.

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7. A method as defined in claim 1, further comprising determining a number of unique visitors to the web site, wherein the rank is based on the number of unique visitors.

8. An apparatus to rank an influence of a web site, comprising:

an authority determiner to determine a number of inbound links to a web site, the web site comprising posts that are associated with a topic;

a virality determiner to calculate elapsed times between time adjacent posts that are relevant to the topic; and

a web site ranker to determine a rank of the web site based on the number of inbound links and times between adjacent ones of the inbound links.

9. A tangible computer readable storage medium comprising computer readable instructions which, when executed, cause a processor to at least:

access a query based on a topic term;

determine topic specific posts by applying the query to a first plurality of posts to a web site;

compare the topic specific posts to a list of web sites to determine a topic volume per site;

determine a plurality of inbound links to the first plurality of posts;

determine a number of inbound links to the posts that are relevant to the topic term by comparing the topic volume per site and the inbound links; and

generate a rank of the web site based on the number of inbound links to the posts that are relevant to the topic term and times between the inbound links.

10. A tangible computer readable medium as defined in claim 9, wherein the instructions are further to cause the processor to calculate elapsed times between postings of adjacent ones of the inbound links by:

determining posting times of posts that are relevant to the topic term;

comparing the posting times to the inbound links to determine a first list of inbound links and posting times of the inbound links; and

comparing the posting times of the inbound links to the topic specific posts to generate a second list of (1) inbound links, (2) posting times, and (3) posts associated with the inbound links and the posting times.

11. A tangible computer readable medium as defined in claim 10, wherein the instructions are to further cause the processor to calculate a median elapsed time by removing an outlier from the list of (1) the inbound links, (2) the posting times, and (3) the posts associated with the inbound links and the posting times.

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12. A tangible computer readable medium as defined in claim 10, wherein the instructions are to cause the processor to perform the comparing using a join operation.

13. A tangible computer readable medium as defined in claim 9, wherein at least a portion of the plurality of inbound links are received from a web site monitor.

14. A tangible computer readable medium as defined in claim 13, wherein the received portion of the plurality of inbound links comprises posts having a number of inbound links that is greater than a threshold.

15. A tangible computer readable medium as defined in claim 9, wherein the instructions are to further cause the processor to determine a number of unique visitors to the web site, wherein the rank is based on the number of unique visitors.

16. An apparatus as defined in claim 8, wherein the virality determiner is to calculate times between the adjacent ones of the inbound links by:

determining posting times of the posts that are relevant to the topic;

comparing a first list including the posting times to a second list including the inbound links to determine a third list including posting times of the inbound links; and determining the times between the adjacent ones of the inbound links in the third list.

17. An apparatus as defined in claim 16, wherein the virality determiner is further to arrange the third list chronologically.

18. An apparatus as defined in claim 16, wherein the virality determiner is to compare the first list including the posting times to the second list including the inbound links by determining matches between first post identifiers corresponding to the posting times and second post identifiers corresponding to the inbound links.

19. A method as defined in claim 2, further comprising arranging the inbound links chronologically according to the posting times of the inbound links.

20. A method as defined in claim 2, wherein comparing the posting times to the inbound links comprises determining matches between first post identifiers corresponding to the posting times and second post identifiers corresponding to the inbound links.

21. A method as defined in claim 1, wherein the inbound links comprise a first web link from another web site to a first one of the posts that are relevant to the topic term.

22. A method as defined in claim 2, wherein the posting times of the inbound links comprise corresponding times at which web sites containing the inbound links were posted.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

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Page 1 of 1

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the Claims

Column 17, line 14 (Claim 9): after “readable” delete “storage”

Signed and Sealed this
Eighth Day of March, 2016

A handwritten signature in black ink, reading "Michelle K. Lee". The signature is written in a cursive style with a long, sweeping underline.

Michelle K. Lee
Director of the United States Patent and Trademark Office